COMMUNICATION DEVICE WITH CODE SEQUENCE SELECTION SYSTEM

TECHNICAL FIELD

This invention is related in general to communication devices and more particularly to code division multiple access (CDMA) communication devices.

BACKGROUND OF THE INVENTION

In direct sequence Code Division Multiple Access (CDMA) systems, many transmitters may operate in the same frequency space. The signals are discriminated at the receiver by the difference in their pseudo-random spreading sequences or codes. Some existing systems, use a centralized base station to allocate spreading sequences or codes. These codes are selected from among a number of codes that each communication device is programmed with. The use of a base station requires that a central station keep track of all the communications between communication devices. Such a requirement demands the maintenance of a centrally located base station along with sophisticated communication equipment.

Yet in systems with no centralized base station, the codes are preprogrammed in the communication devices and are selected manually by the user. With no base station to dynamically allocate codes, the efficient reuse of codes is prevented. It is therefore desired to have a CDMA system with no base station without sacrificing code reuse and system efficiency.

SUMMARY OF THE INVENTION

In summary, a code division multiple access (CDMA) communication system is disclosed having a plurality of spreading codes including a control code. The communication system comprises a first and a second communication device. The first communication device is adapted to transmit a signal spread by the control code and inclusive of a request for an optimum spreading code. The second communication device includes a receiver for receiving the signal and means for identifying an optimum spreading code. The second communication device also includes a transmitter for transmitting the optimum spreading code to the first communication device. Upon this handshake, the first and second communication devices communicate using the optimum spreading code.

In other aspects of the present invention, a communication device having the ability to communicate to other devices using control codes is disclosed.

DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a communication system in accordance with the present invention.

FIG. **2** shows a block diagram of a communication device in accordance with the present invention.

FIG. **3** shows a flow chart of the operation of the communication system in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, a code division multiple access (CDMA) communication system is shown in accordance with the present invention. A first communication device **100** includes an antenna **102** and a second communication device **106** includes an antenna **104**. In the preferred embodiment the first communication device **100** is the initiator or the originator and the second communication device **106** is the target communication device. These communication devices communicate to each other using communication device frequency signals and spreading codes. This communication system is preferably a Direct Sequence Code Division Multiple Access (DS-CDMA) communication system. As is known in the art, in such a system, many pairs of users may operate in the same frequency space and are separated from each other by using different pseudo-random spreading sequences or codes. It is the low cross-correlation aspect between the different spreading codes that allows the pairs of users to operate independently on the same frequency. An average measurement of the interference encountered between codes is mean square cross-correlation. Since the cross-correlation between the codes will depend on what time offset is between them the mean square cross-correlation is a better interference measurement. The means square cross-correlation, r, can be evaluated by the following formula:

$$\rho^2 = \frac{1}{N} \sum_{k=0}^{N-1} (r(\tau_k))^2$$

where:

$$r(\tau_k) = \int_O^{NT} c_1(t)c_2(t + \tau_k)dt$$

N=Sequence Length

t=chip duration

t_k=Kth offset

$C_m(t)$=M^{th} code sequence

Different pairings of codes (Gold codes for example) will have different mean square cross-correlation values. This means how much another communicator interferes with your particular communication depends on which code it uses, and how the pairing with the code used cross-correlates. Basically by measuring the mean square cross-correlation between a code and what is on the channel, one can get a measure of how much this particular code will be interfered with in a subsequent communication, and which codes are being used in the system. In the present invention, the first communication device **100** transmits a signal spread by a control code, this signal includes a request for an optimum spreading code. The second communication device **106** receives this signal and recovers its contents using the known control code. It is noted that this control code is common for all communication devices in the communication system **10**. Therefore, communication devices such as **100** and **106** are aware that each signal must be cross-correlated with the control code to determine if the signal contains control information, such as the one transmitted by the first communication device **100** requesting an optimum spreading code.

The signal, after being received by the second communication device **106**, is decoded and the request for an optimum spreading code is acted upon. The communication device **106** proceeds to identify the optimum spreading code that it wishes to receive signals on. The identity of this spreading code is then transmitted to the communication device **100**, using preferably the control code. This signal is received by the communication device **100** and the optimum code is recovered. Henceforth, communication from the communication device